CONTAMINATED SITES REHABILITATION POLICY

Gouvernement du Québec
Ministère de l'Environnement
Direction des substances dangereuses

Sainte-Foy, February 1988

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I. OVERVIEW

Over the past few decades, outmoded industrial complexes have been closed down and demolished trough out North America. The process is now firmly established, and will accelerate in coming years. According to a recent report entitled Guide to the Environmental Aspects of Decommissioning Industrial Sites, prepared for the Canadian government, between 1984 and 1990 approximately 20 percent of the existing industrial plant will be shut down economic reasons.

While in operation, a number of these industrial complexes employed or generated hazardous substances for many years. As a result of daily discharges of industrial wastes, accidental spills or the on-site burial, these substances contaminated surrounding soil and ground water.

At a time when plants are being demolished, it is necessary to examine this type of contamination to evaluate the need to require possible restrictions on ulterior land use, and the relevance of carrying on restoration work.

This step is all the more important as many former industrial lots are likely to be re-used for different purposes, e.g. the construction of residential neighbourhoods, businesses, parks, and so on.

The return of a portion of suburban populations to city centres, the ideal location of the lots and their low cost make them attractive to potential developers. Contamination of the land on which building is to take place will obviously affect these projects.

In Québec, a number of landowners and developers wishing to sell or re-use former industrial lots have recently asked the advice of the ministère de l'Environnement du Québec (MENVIQ) on the need for intervention, and have sought and to ascertain the degree of decontamination to be achieved before they are redeveloped.

Similarly, numerous concerned parties, such as industrialists, consultants, pressure groups and the public at large, have indicated their desire to see the government adopt a broad policy regulating the development of contaminated land.

Initially, the MENVIQ established criteria for evaluating the contamination of soil and ground water, following consultations with appropriate authorities in industrialized nations already dealing with similar problems. The use of these criteria, combined with a knowledge of the hydrogeological properties of the soils in question, the contaminants dispersal area, the ecotoxicological properties of the substances and the type of use planned for the land, has made it possible to determine the degree of decontamination to be achieved on a number of projects now under way, thus ensuring safe development.

Subsequently, the MENVIQ specified various types of intervention which make it possible to ensure proper handling of contaminated soil. Restoration measures will be applied according to departmental guidelines.

The Contaminated Sites Rehabilitation Policy is a response to questions from the public at large from various concerned parties which establishes the MENVIQ's broad policy directions on the matter.

II. PREMISES

The Contaminated Sites Rehabilitation Policy has been elaborated on the basis of four major premises, on which this document is based:

1. From an environmental standpoint, it is desirable to recover former industrial lots of which the soil has been contaminated.

   The use of lots containing contaminated soils could simply be prohibited; the land could be fenced off and closed to the public. As most contaminated lots are located in city centres, the prohibited zones (former plant yards, outmoded industrial complexes and storage zones with dubious histories) would become increasingly numerous. This method of solving the problem of contaminated soil would be out of step, however, with current trends in post-industrial societies, where emphasis is placed on the maximization of urban potential, the recovery and redevelopment of old buildings, the return of residents to city centres, and the creation of new living areas and parks in the heart of former industrial zones.

   It seems more desirable to follow these trends, to allow the redevelopment of such land and the optimum use of former industrial lots, insofar as the nature of contaminants, the degree of contamination and the geological and hydrogeological characteristics of the land are compatible with the use to which the land is to be put. Such compatibility can be attained through decontamination.

   Redeveloping former industrial sectors, well served by all manner of installations, makes it possible to save energy and money which would otherwise be required to establish peripheral infrastructures, and to maintain peripheral land for other uses such as farming, forestry and so forth.

   Re-using the land often leads to an appreciable improvement in the quality of life of neighbouring residents. The elimination, in the heart of residential sectors, of vacant lots and derelict plants, the consolidation of otherwise dispersed populations in residential areas, and the creation of parks are all positive achievements. Mention should also be made of the

elimination of sources of contamination which are likely to threaten, to varying degrees, public health and the environment.

Moreover, the attractiveness of redeveloping such land encourages potential developers to assume responsibility for decontamination.

2. Various groups and the public at large have demanded the implementation of a policy respecting the rehabilitation of contaminated land.

Various concerned parties, such as industrialists, consultants, pressure groups and the public at large, have asked the government to adopt a policy governing the handling of contaminated land.

Of all the groups which have demanded the adoption of such a policy, including criteria to ascertain the degree of decontamination to be achieved on land slated for redevelopment and different methods of intervention, the most pressing demands have come from groups of developers and the owners of contaminated land.

Awareness among landowners and developers of the far-reaching consequences of contaminants on land belonging to them, or on land underlying the facilities they plan to build, has been a major impetus to the elaboration of the Contaminated Sites Rehabilitation Policy. The desire to fully understand the quality of land they are planning to redevelop, and to ensure the safety of future users, appears to have become a priority for a number of landowners and developers.

3. Municipalities are responsible for the development of their territory; consequently, they are called upon to play a significant role in applying this policy.

Because municipalities have jurisdiction over the issuing of building permits prior to any new development and in light of their knowledge of the territory, they are well placed to inform the ministère de l'Environnement du Québec land redevelopment projets where potential problems necessitate precautions to be taken for the sake of public health and environmental protection.

It is important for municipalities to have a thorough knowledge of former industrial sites where land is to be redeveloped, so that they can ascertain whether previous activity on the site may have led to contamination.

The MENVIQ will work jointly with municipalities under this policy and will inform them of the means available to them, and of procedures for applying the policy.

4. Contaminated land must be properly managed, using specific procedures and criteria.

The objective of this policy is to allow the rehabilitation of contaminated land and to properly manage contaminated soil, bearing in mind the special nature of the problems such soil generates.

Such contamination is diffuse and is not always visible. It may extend over large areas and is hard to delineate. The concentration of a given contaminant and the type of contaminants may vary a great deal between two-sampling points scarcely several metres apart, or at different depths. Often, in the case of indiscriminate elimination or in the case of former industrial lots where a wide variety of products were used, it is not known at the outset which contaminants are likely to be found on the lot to be characterized.

For this reason, it is essential to determine the nature, concentration and distribution of contaminants in the soil and ground water. Criteria related specifically to contaminated lots have been developed and make it possible to evaluate the level of contamination and to specify the degree of decontamination to be achieved according to ulterior land use.

The main concern then is to intervene in such a way that the land is made safe for the type of development anticipated and contaminated soil is handled properly.

III. OBJECTIVES

This policy focuses on three main objectives:

1. Prevent the use of contaminated land to the detriment of health, the environment and property.

To achieve this objective, the MENVIQ intends to pursue the following measures:

(a) Make municipalities more aware of their role when a proposal for redeveloping contaminated land is submitted to them, and inform them of procedures enabling them to decide whether it is relevant for development to proceed on land used in the past for industrial purposes.

This step is aimed at making municipalities aware of the importance of preventive characterization of potentially contaminated land prior to redevelopment, whether for residential, commercial, industrial or recreational purposes, the installation of aqueducts in contaminated soil, or farm use.

(b) Establish a procedure enabling municipalities and the MENVIQ to jointly control such projects.

(c) Provide municipalities with a list of activities likely to cause soil contamination, so that they can intervene as soon as a building permit is requested.

(d) Increase awareness among the owners of land which may be contaminated by toxic substances, among contractors, consultants specializing in the environment, geotechnical laboratories, government departments and development agencies, of the importance of ascertaining the presence in the soil and ground water of toxic substances, especially before use of the land is modified. The information campaign will also reach the public at large, thus making as many people as possible aware of the question

of contaminated soil. The steps just outlined indicate the MENVIQ's wish to adopt preventive measures in this field.

To implement its policy, the MENVIQ is stressing information and increased awareness among concerned parties. It is in everyone's interest to squarely face the problem of contaminated land.

2. Promote the recovery of resources by facilitating the redevelopment of contaminated land insofar as the degree of decontamination achieved is compatible with the use contemplated and is safe for users and the environment.

To achieve this objective, the MENVIQ intends to pursue the following measures:

(a) Issue notices to the owners of potentially contaminated land at various phases of the project (directives concerning the characterization study, approval of the characterization study, approval of the choice of remedial measures) according to the proposed uses to which the land is to be put.

(b) Promote technology transfers and development.

(c) Provide concerned parties with relevant information.

3. Ensure that contaminated soil is handled safely.

To achieve this objective, the MENVIQ intends to pursue the following measures:

(a) Elaborate a procedure which makes it possible, depending on the site-specific case, to establish a method of intervention which is acceptable from an environmental standpoint.

(b) Identify quality criteria which must be complied with when the method of intervention is applied, by means of technical guides.

(c) Promote the adoption of appropriate technologies to safely treat contaminated soil, or ensure that containment or burial measures are carried out safely.

(d) Train the necessary staff and assign them to supervise the management of contaminated soil.

IV. MANAGEMENT PROCEDURES AND RESPONSIBILITIES OF CONCERNED PARTIES

A number of concerned parties are in a position to inform the ministère de l'Environnement du Québec of potential hazards related to the contamination of land, especially developers who believe that an ounce of prevention is worth a pound of cure, residents who may be future users or who are aware of contamination, and environmental groups. At various stages of a project proposed by a developer, other concerned parties can inform the department, such as when lots are sold, titles are searched or projects are elaborated.

The MENVIQ feels that municipalities, in particular, are in an excellent position to advise the department when a project involves the risk of soil contamination. Because of the role they play in managing their territory, municipalities can inform the department of development projects which are likely to involve lots with contaminated soil, thus ensuring that Quebecers and the environment are better protected.

This chapter proposes a management process which will enable municipalities and developers to implement as efficiently as possible the Contaminated Sites Rehabilitation Policy (see the figure on page 13). The procedure involves the following phases:

1. A developer wishing to undertake a project must apply to the municipality for a building permit, in accordance with prevailing municipal by-laws. If the developer is aware of, or suspects, soil contamination, he must inform the municipality.

2. The municipality will examine the sector affected by the project and consult the list of activities likely to contaminate the soil (see the list in Appendix 1). Because of its knowledge of the territory and the community, it is in a position to ascertain whether or not contamination poses a threat. Should there be no threat of contamination, the municipality will follow normal procedures governing the issuing of building permits. In the event that it suspects that contaminants are present, it will ask the

developer to seek the opinion of the MENVIQ and it will inform the department of this request.

3. The developer will submit the project to the MENVIQ. Once the department has examined the project, it will set out guidelines for the characterization study and will inform the municipality accordingly. The developer will submit details of the characterization to the department and, following agreement with the latter, will carry out the characterization of the lot (soil and ground water, according to the case). The developer will also submit, if need be, a proposal concerning measures for restoring and handling soil, following the guidelines of this policy. Once it has received this proposal and the characterization report, the MENVIQ will give notice to the developer on the compatibility of the project with the degree of contamination of the soil and ground water.

4. The developer will submit his request for a building permit to the municipality, accompanied by the department's notice. The municipality will then authorize or reject the project, in accordance with the powers currently invested in it.

The role of the MENVIQ in applying the Contaminated Sites Rehabilitation Policy is essentially technical in nature. It is aimed at establishing a number of rules, to ensure that development does not take place to the detriment of public safety or respect for the environment.

PROCEDURE FOR MANAGING CONTAMINATED LAND

PHASE 1: THE DEVELOPER

Redevelopment project in an industrial zone → Application to municipality for a permit

PHASE 2: THE MUNICIPALITY

Examines sector affected by project and consults the list of activities likely to contaminate the soil

- No problem → Building permit issued
- Contamination suspected → Asks developer to seek the opinion of the MENVIQ and informs the department of the request

PHASE 3: DEVELOPER–MINISTÈRE DE L'ENVIRONNEMENT

Preparation of the detailed characterization plan of the site → Characterization of the site → Proposed measures for restoring and handling soil → MENVIQ issues notice to the developer

PHASE 4: DEVELOPER–MUNICIPALITY

Request for building permit accompanied by the notice of the ministère de l'Environnement → Municipality authorizes or refuses the project

Nature of the Notice

The notice issued by the department will generally take into account the characterization and, if need be, restoration measures.

(a) Characterization

The department will issue its notice following submission of the characterization study carried out by the developer. Occasionally, the study may be limited to the history of the use to which the land has been put, plants which have been operated on it, and products which have been stored there. However, the study will usually contain a physico-chemical characterization of the lot, in accordance with broad guidelines set by the MENVIQ.

On the basis of the information provided, the department will issue a notice, which will take into account:

1. the proposed use of the site;

2. the degree of contamination of the soil and of ground water and surface water;

3. the geological and hydrogeological characteristics of the site under study, i.e. nature of the soil, depth of the water table, leaching, the threat of the contamination's spreading and so on;

4. the ecotoxicological properties of contaminants found on the site.

The notice will indicate the degree of contamination of the site, and the relevance of either carrying out the proposed development project on it or of first undertaking restoration measures.

To ascertain the degree of contamination of the soil and of ground water and surface water, the MENVIQ has developed an assessment grid (see Appendix 2).

The type of use proposed will determine the degree of decontamination to be achieved. For example, more extensive decontamination will be required in a residential or farming zone than in an industrial zone.

To conclude, mention should be made of changes in criteria for assessing the contamination of soil and ground water. The degree of risk currently posed by environmental pollutants may shift as new knowledge becomes available. It is essential, in this field especially, to be flexible.

(b) Restoration

When the characterization study concludes that intervention on the site is necessary, the developer must carry out remedial measures to make the site compatible with his development project.

The notice of the MENVIQ respecting the proposed restoration measures will take into account the type and degree of soil contamination. The method of intervention must be chosen according to the procedure set out in Appendix 3. Various solutions fall into three categories:

1. The treatment of contaminated soil, through thermal, physical, chemical or biological processes;

2. Secure landfill cells for contaminated soil;

3. In situ containment measures.

The method of intervention selected must comply with the technical and administrative requirements outlined in various technical guides which the MENVIQ has produced (see Appendix 4).

In addition to providing developers with technical advice as regards characterization studies and restoration measures, the department will also monitor implementation of remedial measures.

V. BROAD OUTLINES OF THE CONTAMINATED SITES REHABILITATION POLICY

The Contaminated Sites Rehabilitation Policy advocated by the MENVIQ states that:

- It is advisable to allow the recovery of former industrial lots insofar as th quality of the soil is compatible with the proposed use to which the land is to be put.

- When a developer plans to re-use former industrial lots or other land likely to be contaminated, he must first conduct a characterization study of the land which indicates the nature, extent and current or potential impact of possible contamination. The MENVIQ has developed criteria for ascertaining the contamination of soil and ground water in order to facilitate the characterization study.

- Before it is redeveloped, a lot must, if necessary, be decontaminated:

  . according to the proposed development, to ensure that it does not threaten the health of future users nor cause pollution;

  . in such a way that it no longer has any significant impact on the environment;

  . in such a way that it will not pose any harm to buildings or services to be located there.

- Contaminated soil must be safely treated, buried or securely contained.

  . The MENVIQ will favour permanent rather than temporary solutions;

  . Developers will be encouraged to use treatment technologies to decontaminate soil;

. The establishment of secure landfill cells for contaminated soil must comply with MENVIQ requirements, which are set out in the technical guide prepared in conjunction with this policy.

- Developers or landowners will be responsible for studies and work related to the characterization and the restoration of contaminated soil.

APPENDIX 1

APPENDIX 1

LIST OF ACTIVITIES LIKELY TO CONTAMINATE SOIL

To identify lots on which the soil is likely to be contaminated, account must be taken of the type of activity carried on there. The following list specifies those activities which warrant special attention.

THE ELIMINATION OF WASTE AND OTHER RESIDUES

- Sanitary landfill and disposal of dry materials
- Backfilling using industrial residues
- Elimination of industrial wastes
- Snow removal dumps
- Garbage dumps
- Disposal of mining residues

INDUSTRIAL AND COMMERCIAL ACTIVITIES

- Chemical and petrochemical industry
- Pharmaceutical industry
- Pesticide industry
- Paint and lacquer industry
- Solvent recycling industry
- Pulp and paper industry
- Metallurgical industry
- Electrotechnical industry
- Galvanizing industry
- Foundries
- Wood preservation industry
- Tanneries
- Naval shipyards
- Textile industry
- Coking plant (plant manufacturing artifical gas using coal, tar refining)
- Fertilizer industry
- Battery, used oil, liquid waste and barrel recycling plants
- Service stations
- Dry cleaners
- Automobile, bus and subway repair and maintenance workshops
- Transformer substations (condensers)

STORAGE AND TRANSFER OF HAZARDOUS SUBSTANCES

- Storage of chemical and petrochemical products
- Storage of pesticides
- Storage of solvents
- Oil pipeline rights-of-way

LAND SPREADING

- Land spreading of contaminated sediments
- Land spreading of petroleum residues
- Land spreading of sludge from water purification plants or septic tanks

APPENDIX 2

APPENDIX 2

CRITERIA FOR ASCERTAINING THE CONTAMINATION OF SOIL AND GROUND WATER
(VERSION ADOPTED ON FEBRUARY 15, 1988)

	SOIL mg/kg of dry matter (ppm)			GROUND WATER (ppb) ug/L		
	A	B	C	A	B	C
I - HEAVY METALS						
Arsenic (As)	10	30	50	5	50	100
Barium (Ba)	200	500	2000	50	1000	2000
Cadmium (Cd)	1,5	5	20	1	5	20
Chrome (Cr)	75	250	800	15	40	500
Cobalt (Co)	15	50	300	10	50	200
Copper (Cu)	50	100	500	25	500	1000
Lead (Pb)	50	200	600	10	50	100
Mercury (Hg)	0,2	2	10	0,1	0,5	1,0
Molybdenum (Mo)	2	10	40	5	20	100
Nickel (Ni)	50	100	500	10	250	1000
Selenium (Se)	1	3	10	1	10	50
Tin (Sn)	5	50	300	10	30	150
Silver (Ag)	2	20	40	5	50	200
Zinc (Zn)	100	500	1500	50	5000	10000
II -MINERAL POLLUTANTS						
NH_4	N.A.	N.A.	N.A.	200	500	1500
Br (dissolved)	N.A.	N.A.	N.A.	100	500	2000
Br (free)	20	50	300	N.A.[2]	N.A.[2]	N.A.[2]
CN (free)	1	10	100	40	200	400
CN (total)	5	50	500	40	200	400
F (dissolved)	N.A.	N.A.	N.A.	300	1500	4000
F (free)	200	400	2000	N.A.[2]	N.A.[2]	N.A.[2]
PO_4(in P)	N.A.	N.A.	N.A.	50	100	700
NO_3 (in N)	N.A.	N.A.	N.A.	10	10000	-
NO_2 (in N)	N.A.	N.A.	N.A.	20	1000	-
Sulfide (H_2S)	N.A.	N.A.	N.A.	10	50	500
S total	500	1000	2000	-	-	-

N.A.: not applicable
-: No criteria available (February 15, 1988)

CRITERIA FOR ASCERTAINING THE CONTAMINATION OF SOIL AND GROUND WATER
(continued)

	SOIL mg/kg of dry matter (ppm)			GROUND WATER (ppb) ug/L		
	A	B	C	A	B	C
III- MONOCYCLICAL AROMATIC VOLATILE COMPOUNDS (MAVCs)						
Benzene	0,1	0,5	5	0,5	1	5
Ethylbenzene	0,1	5	50	0,5	50	150
Toluene	0,1	3	30	0,5	50	100
Chlorobenzene	0,1	1	10	0,1	2	5
1,2 dichlorobenzene	0,1	1	10	0,1	2	5
1,3 dichlorobenzene	0,1	1	10	0,1	2	5
1,4 dichlorobenzene	0,1	1	10	0,1	2	5
Xylene	0,1	5	50	0,5	20	60
Styrene	0,1	5	50	0,5	40	120
BTEX[3] (summation)	-	-	-	-	-	-
IV- PHENOLIC COMPOUNDS						
Non chlorinated [4] (each)	0,1	1	10	1,0	3	20
Chlorophenols[4] (each)	0,1	0,5	5	1,0	2	5
Chlorophenols[4] (summation)[5]	0,1	1,0	10	1,0	4	10

CRITERIA FOR ASCERTAINING THE CONTAMINATION OF SOIL AND GROUND WATER
(continued)

	SOIL mg/kg of dry matter (ppm)			GROUND WATER (ppb) ug/L		
	A	B	C	A	B	C
V- POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)						
Benzo (a) anthracene	0,1	1	10	0,1	0,5	2
1,2 benzanthracene 7,2 dimethyl	0,1	1	10	0,1	0,2	1
Dibenzo (a,h) anthracene	0,1	1	10	0,1	0,2	1
Chrysene	0,1	1	10	0,1	1	5
3 methylcholanthrene	0,1	1	10	0,1	0,2	1
Benzo (b) fluoranthene	0,1	1	10	0,1	0,2	1
Benzo (j) fluoranthene	0,1	1	10	0,1	0,2	1
Benzo (k) fluoranthene	0,1	1	10	0,1	0,2	1
Benzo (g,h,i) perylene	0,1	1	10	0,1	0,2	1
Benzo (c) phenanthrene	0,1	1	10	0,1	0,5	2
Pyrene	0,1	10	100	0,2	7	30
Benzo (a) pyrene	0,1	1	10	0,1	0,2	1
Dibenzo (a,h) pyrene	0,1	1	10	0,1	1	5
Dibenzo (a,i) pyrene	0,1	1	10	0,1	1	5
Dibenzo (a,l) pyrene	0,1	1	10	0,1	1	5
Indeno (1,2,3,c,d) pyrene	0,1	1	10	0,1	1	5
Acenaphtene	0,1	10	100	0,5	20	30
Acenaphtylene	0,1	10	100	0,5	10	20
Antrhacene	0,1	10	100	0,2	7	20
Fluoranthene	0,1	10	100	0,1	2	10
Fluorene	0,1	10	100	0,1	2	10
Naphtalene	0,1	5	50	0,2	10	30
Phenanthrene	0,1	5	50	0,1	1	5
PAHs (summation)[5]	1	20	200	0,2	10	50

CRITERIA FOR ASCERTAINING THE CONTAMINATION OF SOIL AND GROUND WATER
(continued)

	SOIL mg/kg of dry matter (ppm)			GROUND WATER (ppb) ug/L		
	A	B	C	A	B	C
VI- CHLORINATED HYDROCARBONS (CHs)						
Aliphatic CH[4]						
(each)	0,3	5	50	1	10	50
(summation)[5]	0,3	7	70	1	15	70
Chlorobenzene[4]						
(each)	0,1	2	10	0,3	2	5
(summation)[5]	0,1	4	20	0,3	4	10
Hexachlorobenzene	0,1	2	10	0,1	0,5	2
Polychlorinates biphenyls	0,1	1	10	0,1	0,2	1
Chlorodibenzo-p-dioxines	-	-	-	-	-	-
2,3,7,8 tetrachloro-dibenzo-p-dioxine	-	-	-	-	-	-
Chlorodibenzo furanes	-	-	-	-	-	-

CRITERIA FOR ASCERTAINING THE CONTAMINATION OF SOIL AND GROUND WATER
(continued)

	SOIL mg/kg of dry matter (ppm)			GROUND WATER (ppb) ug/L		
	A	B	C	A	B	C
VII- PESTICIDES						
a) Organochlorinated						
Each	-	-	-	-	-	-
Summation	-	-	-	-	-	-
Aldrine + Dieldrine	-	-	-	0,05	0,7	2
Chlordane (total isomers)	-	-	-	0,05	0,7	2
DDT	-	-	-	0,05	30	60
Endrine	-	-	-	0,05	0,2	0,5
Epoxyde of heprachlor	-	-	-	0,05	3	5
Lindane	-	-	-	0,05	4	10
Methoxychlore	-	-	-	0,05	100	200
b) Carbamates						
Carbaryl	-	-	-	0,05	70	150
Carbofurane	-	-	-	0,05	70	150
c) Derivatives of chlorophenoxy carboxylic acids						
2-4-D	-	-	-	0,05	100	200
2,4,5.TP	-	-	-	0,05	10	20
d) Organophosphoric						
Diazinon	-	-	-	0,05	14	30
Fenitrothion	-	-	-	0,05	7	20
Parathion	-	-	-	0,05	35	70
Parathion-methyl	-	-	-	0,05	7	20

CRITERIA FOR ASCERTAINING THE CONTAMINATION OF SOIL AND GROUND WATER
(continued)

	SOIL mg/kg of dry matter (ppm)			GROUND WATER (ppb) ug/L		
	A	B	C	A	B	C
e) Derivatives of pyridylium						
Diquat	-	-	-	0,05	50	100
Paraquat	-	-	-	0,05	7	20
f) Trichloroacetates						
Piclorame	-	-	-	0,05	1	2
Pesticides (Summation)[5]	0,1	2	20	0,05	100	200
VIII- INDICATORY PARAMETERS						
Phenolic compounds by colorimetric method[4]	0,1	1	10	1,0	2	5
Gasoline	100	150	800	1000	1500	3000
Mineras oil and grease	100	1000	5000	100	1000	5000

N.A.: Not applicable
- : No criteria available (February 15, 1988)

1) Criterion (A) concerning ground water for elements in Groups I has been evaluated according to the average value of natural concentrations found in Québec ground water, by compiling findings from more than 25 sampling sites located in 12 Québec municipalities, with input from the Québec laboratory and the Direction des eaux souterraines et de consommation. An average of findings for soil analyses drawn from a ministère de l'Energie et des Ressources date bank examined.

2) In aqueous environments, so-called "free" forms are dissolved.

3) Summative criteria respecting BTEXs (benzene, toluene and xylene) are to come.

4) See the "Remarks" section.

5) The summation of the content detected for each compound in individual doses is considered.

REMARKS

(A) Non-chlorinated phenolic compounds

The following compounds are considered in this category:

2,4 - dimethylphenol
2,4 - dinitrophenol
2 - methyl 4,6 - dinitrophenol
2 - nitrophenol
4 - nitrophenol
phenol
cresol (ortho, para, meta)

(B) Chlorophenols

The following compounds are considered in this category:

ortho-chlorophenol
meta-chlorophenol
para-chlorophenol
2,6 - dichlorophenol
2,5 - dichlorophenol
2,4 - dichlorophenol
3,5 - dichlorophenol
2,3 - dichlorophenol
3,4 - dichlorophenol
2,4,6 - trichlorophenol
2,3,6 - trichlorophenol
2,4,5 - trichlorophenol
2,3,5 - trichlorophenol
2,3,4 - trichlorophenol
3,4,5 - trichlorophenol
2,3,5,6 - tetrachlorophenol
2,3,4,5 - tetrachlorophenol
2,3,4,6 - tetrachlorophenol
pentachlorophenol

(C) Volatile chlorinated aliphatic hydrocarbons

This category includes the following compounds:

Chloroform
Dichloro - 1,1 ethane
Dichloro - 1,2 ethane
Dichloro - 1,1 ethene
Dichloro - 1,2 ethene
Dichloromethane
Dichloro - 1,2 propane
Dichloro - 1,2 propene (cis and trans)
Tetrachloro - 1,1,2,2 ethane
Tetrachloroethene
Carbon tetrachloride
Trichloro - 1,1,1 ethane
Trichloro - 1,1,2 ethane
Trichloroethene

REMARKS (continued)

(D) Chlorobenzenes

Trichlorobenzenes (all isomers)
Tetrachlorobenzenes (all isomers)
Pentachlorobenzene

(E) Polychlorinated biphenyls

Isomers 1242, 1248, 1254 and 1260 are considered in this category.

(F) Phenolic compounds by colorimetric dose involving 4 - aminoantipyrine

In this instance, phenol itself is considered, along with phenols substituted in ortho and in meta, and even phenols substituted in para by carboxylic, methoxy, and sulphonic acid groups, and by halogens (Cl, F, Br, I). It is acknowledged that the method involving 4 - aminoantipyrine does not permit the quantification of phenols substituted in para by alkyl, aryl, nitro, benzoid, nitroso and aldehyde groups.

For each of the substrates, the grid contains three threshold values, which determine three levels of intervention.

Value A: This value represents background pollution with respect to contaminants found naturally in the milieu, such as metals, oils and grease, and the detection limit with regard to man-mode organic chemical products.

Level A-B: The soil or ground water is slightly contaminated. At this level of contamination, ground water does satisfy drinking quality standards and criteria. However, it is worthwhile to investigate possible sources of contamination and, especially in the case of the water table, to ascertain whether new contaminants continue to enter the water. This may lead to intervention focusing on the soil, particularly if the water is used for drinking.

Usually, at this level of contamination, decontamination will not be undertaken. Should the land be redeveloped for especially sensitive purposes, e.g. surface soil in a residential or a farming sector, it may prove essential to adopt a number of protection measures, such as the excavation of a superficial layer of soil or the addition of a layer of clean soil.

Value B: At this threshold, thorough analyses are necessary.

Level B-C: The soil or ground water are contaminated. At this level, contamination of ground water exceeds quality standards governing water intended for human consumption. Ground water can no longer be used for drinking.

Although the soil is contaminated, it will not automatically be decontaminated, unless the effect of contaminants on the water table necessitates such work.

However, restrictions on land use may be imposed when this level of contamination is observed in the soil. Restoration work may be necessary before the land is used for farming, residential or recreational purposes. Other uses, e.g. industrial or commercial, may be contemplated without decontamination being carried out. In all cases, the extent of the work to be effected, e.g. the depth to which soil must be excavated and so on, will depend upon the nature of the contaminants, ulterior land use and the impact on the water table and the environment in general.

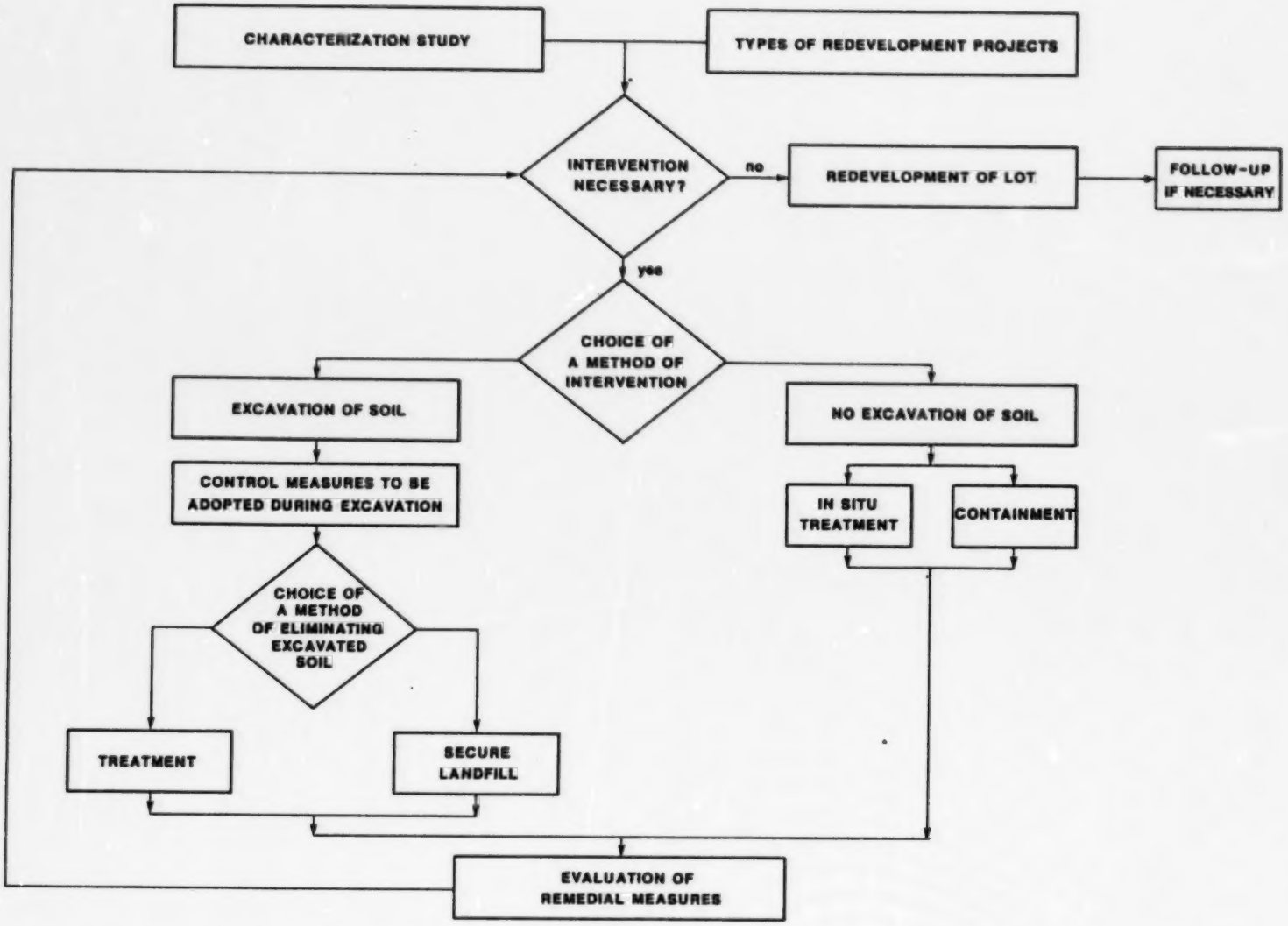
Value C: At this threshold, it may be necessary to take prompt remedial action.

Level C: The soil or ground water are contaminated. Ground water cannot be used for drinking. Concentrations of many contaminants exceed standards governing storm sewer runoff. The water is seriously contaminated; unless it is decontaminated, it will have to be monitored closely.

All uses of such land will be restricted. A thorough analysis must be conducted; in all likelihood, restoration will have to be undertaken before rehabilitation occurs.

It is essential to note that the foregoing criteria have been elaborated strictly as an indication; at no time are they to be regarded as standards.

APPENDIX 3



Appendix 3

PROCEDURE FOR HANDLING CONTAMINATED LAND

APPENDIX 4

APPENDIX 4

PUBLICATIONS DEALING WITH CONTAMINATED LAND

A. Current Publications

- Attention, terrain contaminé

  This brochure contains general information on problems related to contaminated soil, i.e. how to identify contaminated land and possible ways of intervening.

- Terrains contaminés
  Les municipalités, des yeux sur leur territoire

  This document outlines the role of municipalities with respect to the Contaminated Sites Rehabilitation Policy and various situations which may arise when a developer requests a building permit and the project is likely to pose a threat due to soil contamination.

- Contaminated Land: Facing the Issue

  This brochure is intended to make developers more aware of soil contamination and to stress the importance of ascertaining the quality of a lot before carrying out a project. It is also aimed at businesses whose activities are likely to cause soil contamination.

- Guide standard de caractérisation

  This guide outlines procedures which landowners should follow in preparing the characterization of a lot, i.e. historical research, sampling, analysis of soil and ground water, and the final report.

- Procédure pour le choix d'un mode d'intervention sur les sols contaminés

This document proposes methods of treatment, storage or elimination for various levels and types of organic, inorganic or mixed contamination. It sets out a decision-making process to help developers select the most acceptable restoration option from an environmental standpoint.

- Guide technique des mesures de contrôle à effectuer lors des travaux de restauration de sols contaminés

In most instances, the restoration of contaminated land involves excavation, the extent of which is determined in advance by the interpretation of the results of the characterization study.

The purpose of this guide is to ascertain the accuracy of this interpretation during excavation, to ensure that all contaminated soil has been removed and that decontamination objectives have been achieved.

- Guide d'implantation et de gestion des lieux d'enfouissement de sols contaminés

This technical guide describes factors to be considered in choosing a burial site and the concept of high and maximum secure landfill cells. These cells, intended for the burial of contaminated soil, should make it possible to solve several problems facing developers wishing to re-use contaminated sites.

B. Forthcoming Publications

- Guide des méthodes de prélèvement des échantillons d'eau et de sol

This guide is intended mainly for environmental consulting firms, with a view to standardizing their sampling work when characterization studies of contaminated land are conducted.

- Guide des méthodes de conservation et d'analyse des échantillons d'eau et de sol

This guide has been prepared for environemental consulting firms and laboratories with a view to standardizing the chemical analysis of samples and to assist them in preparing characterization studies.

- Guide d'évaluation des techniques de traitement des sols contaminés

Technologies are currently being developed in the industralized nations which could be imported to or developed in Québec. This guide proposes an inventory of various treatment technologies and analyses and assesses these methods.

To obtain information on the Contaminated Sites Rehabilitation Policy, please contact:

Ministère de l'Environnement
Direction des substances dangereuses
3900, rue Marly, 5e étage
Sainte-Foy (Québec)
G1X 4E4

Tél.: (418) 643-3794

To order publications, please contact:

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Direction des Communications et de l'Éducation
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- **MONTRÉAL-LANAUDIÈRE**
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- **LAVAL-LAURENTIDES**
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- **ABITIBI-TÉMISCAMINGUE ET NORD QUÉBÉCOIS**
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